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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/500,288	02/08/2000	Shinichi Nagahama	NICHIA-00800	2385

7590 01/15/2002

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EXAMINER

LOUIE, WAI SING

ART UNIT

PAPER NUMBER

2814

DATE MAILED: 01/15/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/500,288

Applicant(s)

NAGAHAMA ET AL.

Examiner

Wai-Sing Louie

Art Unit

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 02 November 2001.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 9-16 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 9-16 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

### DETAILED ACTION

1. Applicant has canceled previous claims 1-6 and added new claims 9-16. The new rejections are as below.

#### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hong et al. (US 6,177,292) in view of Koide (JP 11-145516).

With regard to claim 9, Hong et al. disclose gallium nitride semiconductor diode (col. 4, line 3 to col. 11, line 64 and fig. 7) comprising:

- A GaN substrate 70 having a single-crystal GaN on its surface. Hong et al. do not disclose the single-crystal GaN layer 70 is formed through a lateral. However, Koide disclose a lateral growth method to form a GaN layer 3 on a sacrificial AlGaN layer. The GaN layer 3 would epitaxially grow in vertical as well as laterally direction (Koide [0001] to [0005] and fig.1). Koide teaches the lateral grow method would not generate cracks and dislocation within the GaN layer (Koide [0004]). Therefore, it would have been obvious to one with ordinary skill in the art to adopt Koide's lateral grow method for Hong's device. Doing so would avoid forming cracks in the GaN layer.

- A device-forming layer 71 made of nitride semiconductor that are formed on the GaN substrate 70 (col. 10, lines 17-42 and fig 7), where the device-forming layer contacting the GaN substrate is made of  $\text{Al}_a\text{Ga}_{1-a}\text{N}$  ( $0 < a < 1$ ).

3. Claims 10-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hong et al. (US 6,177,292).

With regard to claims 10 and 11, Hong et al. disclose the device-forming layer 71 is made of  $\text{Al}_a\text{Ga}_{1-a}\text{N}$  ( $0 < a < 0.1$ ), but do not disclose the concentration of aluminum (col. 10, lines 25-26 and lines 51-52). However, in another embodiment, Hong disclose the AlGa<sub>N</sub> layer 53 is  $\text{Al}_{0.05}\text{Ga}_{0.95}\text{N}$ . Since both embodiments are fabricated by the same technique, it is obvious that the concentration of aluminum of the AlGa<sub>N</sub> layer can be the same.

With regard to claims 12-13, Hong et al. disclose the thickness of the device-forming layer 71 is 3-5  $\mu\text{m}$  (col. 10, lines 26).

4. Claims 14-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hong et al. (US 6,177,292) in view of Kern et al. (US 6,194,742).

With regard to claims 14-15, Hong et al. disclose an n-type  $\text{Al}_a\text{Ga}_{1-a}\text{N}$  ( $0 < a < 1$ ) layer 71 contacting GaN substrate, but do not disclose the  $\text{Al}_a\text{Ga}_{1-a}\text{N}$  layer is grown without an impurity doping. However, Kern et al. disclose an undoped interfacial layer of  $\text{Al}_x\text{In}_y\text{Ga}_{1-x-y}\text{N}$  ( $0 \leq x \leq 1$ ,  $0 \leq y \leq 1$ ). Kern et al. teach an undoped interfacial layer of  $\text{Al}_x\text{In}_y\text{Ga}_{1-x-y}\text{N}$  ( $0 \leq x \leq 1$ ,  $0 \leq y \leq 1$ ) would

increase reliability and reproducibility of the device because the problem associated with cracking of layers (col. 3, lines 1-16). Therefore, it would have been obvious to one with ordinary skill in the art to would provide a device-forming (interfacial) layer. Doing so would increase the reliability of the device. Hong et al. disclose an n-type cladding layer 71 containing Al, an active layer 72 containing InGa<sub>N</sub>, and a p-type cladding layer 73 containing Al.

With regard to claim 16, Hong et al. disclose a layer 52 made of InGa<sub>N</sub> intervening between the Al<sub>a</sub>Ga<sub>1-a</sub>N layer and the n-type cladding layer. Hong et al. disclose layer 52 is a buffer layer of 1000 Å thick. One with ordinary skill in the art would know the buffer layer is used for buffering the minor lattice mismatch and thermal expansion. Therefore, it would have been obvious to one with ordinary skill in the art to provide an InGa<sub>N</sub> buffer layer. Doing so would make up the minor lattice mismatch and thermal expansion to prevent cracking occur.

### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37

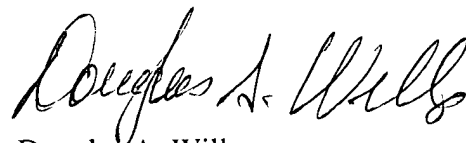
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CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

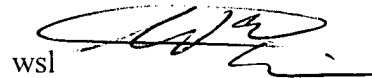
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wai-Sing Louie whose telephone number is (703) 305-0474. The examiner can normally be reached on 7:30 AM to 4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on (703) 306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.



Douglas A. Wille  
Patent Examiner



wsl  
January 10, 2002